# CITY OF NEWARK

# CSO DISCHARGE CHARACTERIZATION STUDY

# MONITORING PROGRAM PROPOSAL AND WORK PLAN

**February 27, 1996**

**Clinton Bogert Associates**
Consulting Engineers since 1924

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## I. Introduction

The Individual NJPDES/DSW General Permit Authorization issued to the City of Newark on June 30, 1995 authorizes the City to operate the City's combined sewer system and discharge untreated wastewater from twenty four CSO points. Twenty-one discharge to the Passaic River, eight to the Newark Airport Peripheral Ditch and one to Second River. One of the permit conditions is to require the City to perform a CSO discharge characterization study.

The City of Newark, the Essex County Seat, is New Jersey's most populous city with 275,000 residents. The 24 square mile City is located along the west banks of Newark Bay and the tidal Passaic River. Major commercial and industrial establishments are located in Newark. Newark is an industrial and transportation hub of the State, with highways, railroads, bridges, a major airport and seaport facilities in the southeastern part of the City. Multi-story buildings in the downtown area form the commercial hub of the City. Heavy industries are mostly concentrated in the low-lying southeastern part of the City and along the Passaic River. The more elevated northern, western and southern sections include a mix of urban residences. commercial development, institutions, parks and light industry.

### A. The Characterization Study Objectives

The purpose of the characterization study is to characterize through monitoring and modeling the response of a sewer system to wet weather events in terms of the amount, location and frequency of CSO volume, and pollutant concentration and mass discharged. Although not a part of the general permit activities, the results of the characterization study will be used in a separate watershed study to assess the impacts of the CSOs and other point and nonpoint sources on the receiving waters and their designated uses. The computer model, field calibrated and verified, will identify storage potential and hydraulic deficiencies, if any, within the collection and conveyance systems. Although not included in the scope of the characterization study, the model will be used in later stages to evaluate the effectiveness of both the nine minimum controls and the long-term CSO control to meet receiving water quality standards.

### B. Study Approach

To develop monitoring program and system model for the City of Newark, and proper calibration and verification of the model, all available drainage area, topographic and landuse data and sewer system information will be compiled. A field verification of the sewer system information will be performed where required. The past CSO flow and quality data and rainfall records collected in the City will be obtained and reviewed to determine its usefulness and the

extent of additional data to be obtained for model development.

### C. Identification of Combined Sewer System and Receiving Waters

The City of Newark is located on the Passaic River at the river's confluence with Newark Bay, which in turn discharges into Lower New York Bay. About 50 percent of the City is served by combined sewers and the remaining area by separate storm and sanitary sewer systems. The City has about 300 miles of collection sewers and delivers its sewage via 22 regulators to the PVSC Plant by two gravity interceptors: (1) the PVSC Main Interceptor that also serves parts of Bergen, Essex, Hudson, and Passaic Counties, and (2) Newark's Southside Interceptor. Much of the City's collection system has been in place for over 100 years.

The City has 20 primary outfalls, including four twin outlets, 15 of which discharge to the Passaic River and five to the Newark Bay via the Peripheral Ditch at the Newark Airport. In addition, there are three storm sewer outfalls that provide relief to combined sewers. The tributary areas of these CSOs range from 3 to 1770 acres. Figures 1 and 2 show the locations of these outfalls and adjacent receiving waters. Table 1 shows the outfall sizes and tributary areas.

### D. CSO Monitoring Program Objectives

The ultimate product of a CSO characterization study for the City of Newark is a sewer system model like SWMM or its equivalent which is representative of the City's sewer system and is able to simulate the response of the system to various precipitation events and characterize overflows in terms of flows and pollutant discharges. The sewer system model will be used as an assessment and a design tool for an optimal operation of the existing system and the development of a CSO control plan to meet the Clean Water Act (CWA) requirements.

The objective of the CSO monitoring program is to obtain time varying dry-weather and wet-weather flow and pollutant concentration data at selected points of the collection and interceptor systems and/or outfalls for model calibration and verification.

## II. Data Needs of the Study

CSO pollutant loads are determined by CSO flows and pollutant concentrations. In addition, meterological data are needed to drive the model for both short-term and long-term analyses. Since precipitation may vary significantly in a short distance, the density of recording gages should be properly considered. The following further explains data needs to develop flows and concentrations with the model.

### CSO Flows

CSO flows are site specific and strongly influenced by the drainage area and conveyance system characteristics and operation of regulator/outfall pipes/tide gate structures. Each combined

## Table 1. CSO Outfall Sizes and Tributary Areas

| Outfall Number | Outfall Name | Outfall Dimensions (in.) Diam or H x W | Tributary Area (acres) | | |
|---|---|---|---|---|---|
| | | | Combined | Separate | |
| | | | | Storm | Sanitary |
| **Passaic River (North to South)** | | | | | |
| 002 | Verona | 72 x 55 | 335 | | 24 |
| 003 | Delavan | 60 | 55 | 24 | |
| 004-005 | Herbert | 51 and 72 x 48 | 224 | | 34 |
| 007* | Third | 15 | 3 | | |
| 008 | Fourth | 48 x 48 | 226 | | |
| 009-010 | Clay | Two 81 x 111 | 1,685 | | 1,580 |
| 011* | Orange | 24 x 24 | 14 | | |
| 012* | Bridge | 15 | 11 | | |
| 013 | Rector | 60 | 121 | | |
| 014 | Saybrook | 75 | 287 | | |
| 015 | City Dock | 90 x 108 | 417 | | |
| 016 | Jackson | 56 x 64 | 77 | | |
| 017 | Polk | 84 x 96 | 207 | | |
| 018 | Freeman | 48 | 75 | | 51 |
| 022 | Roanoke | 60 | 152 | | |
| **Peripheral Ditch Tributaries** | | | | | |
| 023 | Adams | 48 x 144 | 284 | 128 | |
| 024-030 | Wheeler/Ave. A | Two 42 x 60 | 442** | | |
| 025 | Peddie | Four 72 x 96 | 1,770*** | | |
| 026 | Queen | Three 54 x 75 | 209 | | 458 |
| 027-029 | Waverly | 90 and 48 | 266 | 19 | |

*Indicates minor outfall
**Includes 122 acres diverted by Sherman Avenue Relief Sewer
***Excludes 122 acres diverted by Sherman Avenue Relief Sewer

sewer system is unique and information needed for the model should be independently derived.

Model data required includes physical features of the sewershed and combined sewer system. The sewershed data includes drainage subcatchment area, slope, percent imperviousness and soil characteristics which govern infiltration and depression storage. The needed sewer data include pipe sizes, shapes and slopes; hydraulic roughness; sewer invert and ground elevations; regulators and outfall structures. These data are separately developed under the work of "Service Area Drainage and Land Use Report" and "Sewer System Inventory and Assessment Report" that are parts of the CSO Characterization Study.

### CSO Concentrations

Pollutant concentration levels in CSOs are site specific and generally influenced by the strength of dry weather flows, land uses, age and conditions of the collection system and rainfall characteristics (pattern, intensity and duration). Field data collected in many combined sewers show a distinct high pollutant concentration in the initial runoff period followed by rising flow rates but a decreasing pollutant concentration. This initial high concentration is termed "first flush" which contains a disproportionately large percentage of the total pollutant mass in a relatively small percentage of the total flow.

Surface runoff water quality parameters that are used in a model for calculating the pollutant concentration of combined sewage and CSO include pollutant build-up and washoff rates, particle size distribution and particle specific gravity of dry weather flow; street sweeping frequency and efficiency, etc. Sufficient field data should be collected for calibration and verification of these parameters.

## III. Existing Data

The following describes the available information about the City's sewer system and environment that affect CSO flow and pollutant discharged to the Passaic River and Newark Bay. The available field data at the CSOs is also included and evaluated to determine additional field data required.

### A. Combined Sewer System Information

#### CSS History and Development

The City's combined sewers were constructed between 1830 and 1930. Initially, both dry weather flow and stormwater discharge untreated to the Passaic River and the old Newark Meadows drainage basin along Newark Bay. To mitigate the pollution problems caused by these discharges, the PVSC treatment plant and interceptor system were put into service in 1924. The Plant, the largest in New Jersey and fifth largest in the nation, was expanded in the late 1970's to provide secondary treatment, and in the late 1980's to provide sludge treatment. Also, in the 1970's, a Peripheral Ditch was constructed around the Newark Airport complex to provide a

much improved drainage outlet for southeastern Newark. The South Side Interceptor sewer was constructed in 1965and conveyed dry weather flow from the area to the PVSC plant.

CSS Owner and Operation and Maintenance

The City owns the regulators located in the City but these regulators are operated and maintained by PVSC. Due to maintenance problems and obsolescence, all float operated gates, except that upstream of Waverly Ditch Outfall 027-029, have been abandoned or removed, and replaced with fixed orifices and knife gates. Knife gates are remotely operated. When the Plant flow approaches 480 mgd, the PVSC operator closes the gate at one or more of the points of interception until plant flow stabilizes at 480 mgd. The gates are reopened after the rain has ended. The sequencing is based on the operators assessment of the amount of throttling required for the specific rainfall. There are provisions for manual operation of the gates if the telemetry fails.

CSS and Area Description

About 50% of the City is served by combined sewer systems. The largest separate sewer area is the southeastern industrial and airport area. Stormwater from this area drains to Newark Bay and sanitary sewage is sent to the PVSC plant. Sewers in the southwesterly section of Newark along the Hillside Township and Vailsburg section are also separated. Its sewage is treated at the Essex-Union Joint Meeting Treatment Plant in Elizabeth. Another sewer separation area is the northwest section of the City whose sewage is delivered to the PVSC Main Intercepter via an interceptor parallel to Second River. Figure 3 shows the combined sewer and separate sewer areas.

The City is founded on relatively high hills ranging up to an elevation of 225 feet above mean sea level, and the northern area of the City along the Passaic River rises quite steeply from the river. Approximately one-third of Newark, however, is located in the low lying areas bordering the Bay.

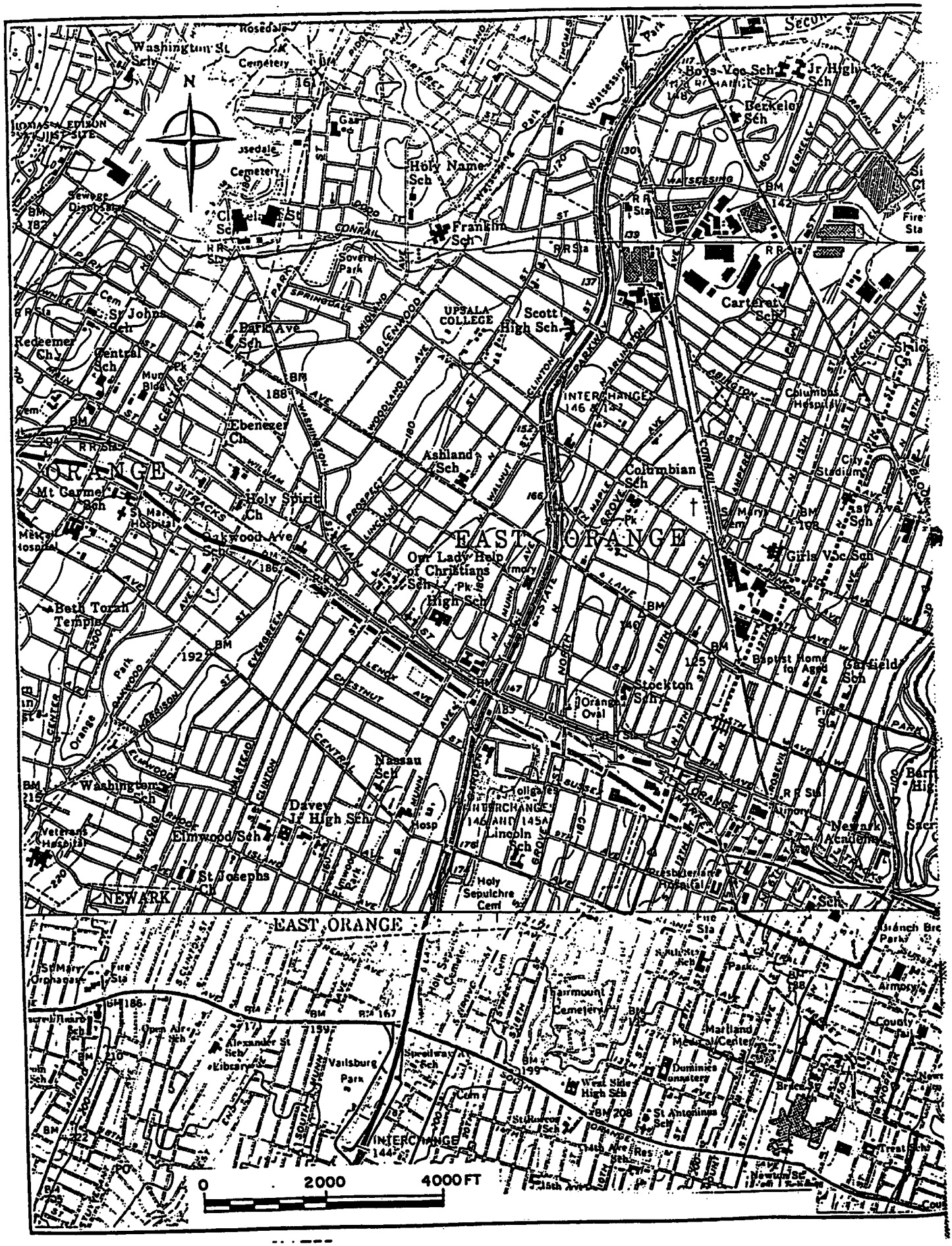
CSS Service Area Population and Land Use Characteristics

The City of Newark was incorporated in 1836 and experienced a steady growth from a population of about 11,000 in 1830 to about 136,000 in 1880, and to about 440,000 in 1930 which is the largest population the City has experienced. After 1950, the City population has been declining. The present population of the City is about 275,000.

The land uses of the City are comprised of about 25% residential, 22% commercial, 28% industrial and 25% open space/parks. The residential area is primarily in the northern and western or higher elevation areas of the City. The heavy industrial area is located along the Passaic River and Newark Bay. The commercial core of the City is located in the central area of the City lying in the Raymond-Saybrook Districts. Newark Airport, located in the southern part of the City, occupies an area of about 2,000 acres.

CITY OF NEWARK


Figure 1


N
Rosedale
Washington St Sch
Cemetery
Holy Name Sch
Franklin Sch
Boys Voc Sch
Jr High Sch
Berkeley Sch
Watsessing Park
Sewage Disposal
Cemetery
Conrail
RR Sta
Fire Sta
Soverel Park
Springdale
Cem
St Johns Sch
Park Ave Sch
Upsala College
Scott High Sch
Carteret Sch
Redeemer Ch
Central Sch
Glenwood Ave
Interchange 146
Columbus Hospital
Ebenezer Ch
Ashland Sch
Columbian Sch
ORANGE
EAST ORANGE
Mt Carmel Sch
Holy Spirit Ch
St Michaels Hospital
Oakwood Ave Sch
Our Lady Help of Christians Sch
Armory
High Sch
Girls Voc Sch
East Ave Sch
Beth Torah Temple
Park
Orange Oval
Stockton Sch
Baptist Home for Aged
Garfield Sch
Nassau Sch
Washington Sch
Davey Jr High Sch
Tollgate
Interchange 146 AND 145A
Lincoln Sch
Elmwood Sch
Veterans Hospital
St Josephs Ch
Holy Sepulchre Cem
Newark Academy
Presbyterian Hospital
NEWARK
EAST ORANGE
St Mary Orphanage
Fire Sta
Open Air Sch
Alexander St Sch
Library
Vailsburg Park
Fairmount Cemetery
Maryland Center
Dominican Cemetery
West Side High Sch
St Antoninus Sch
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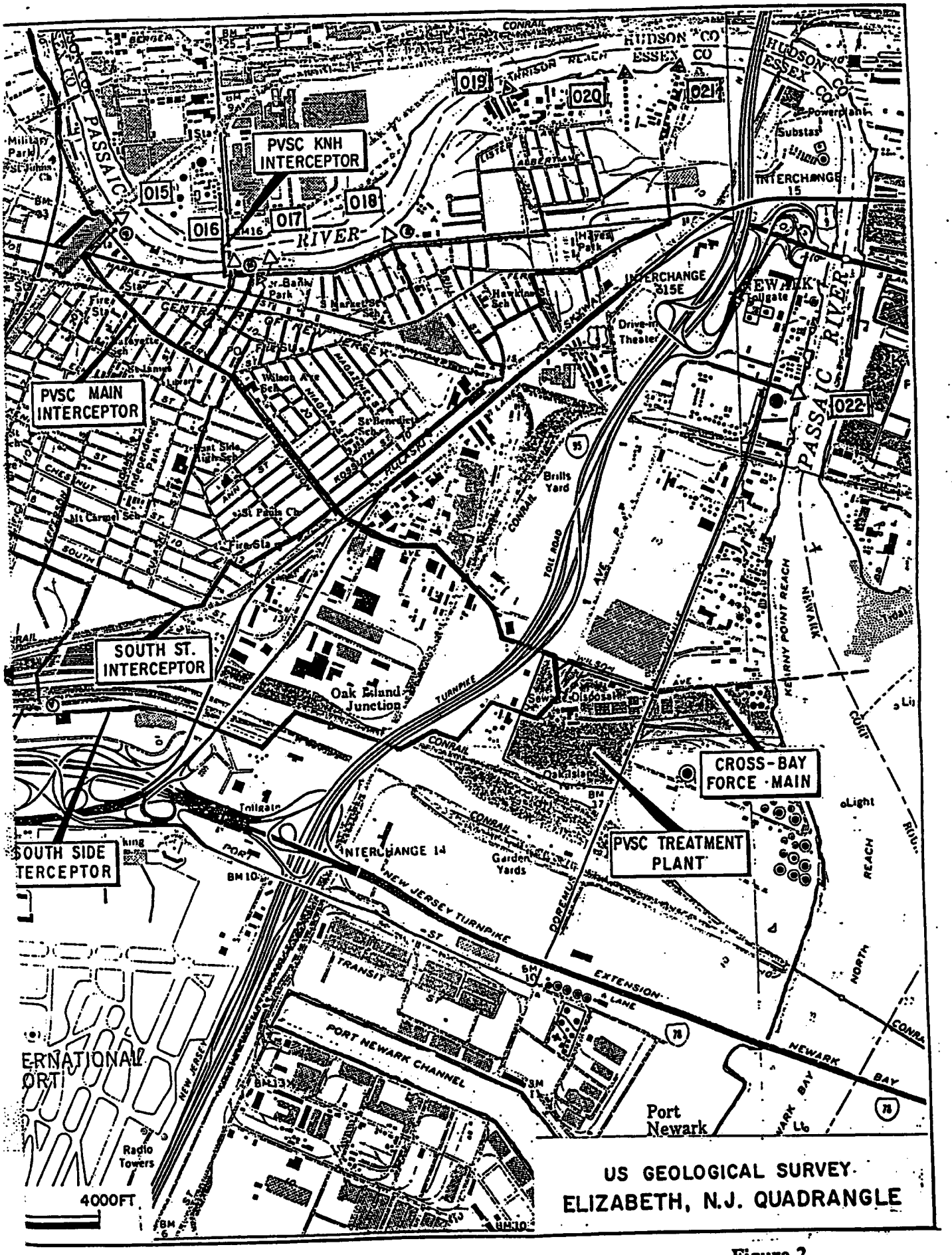
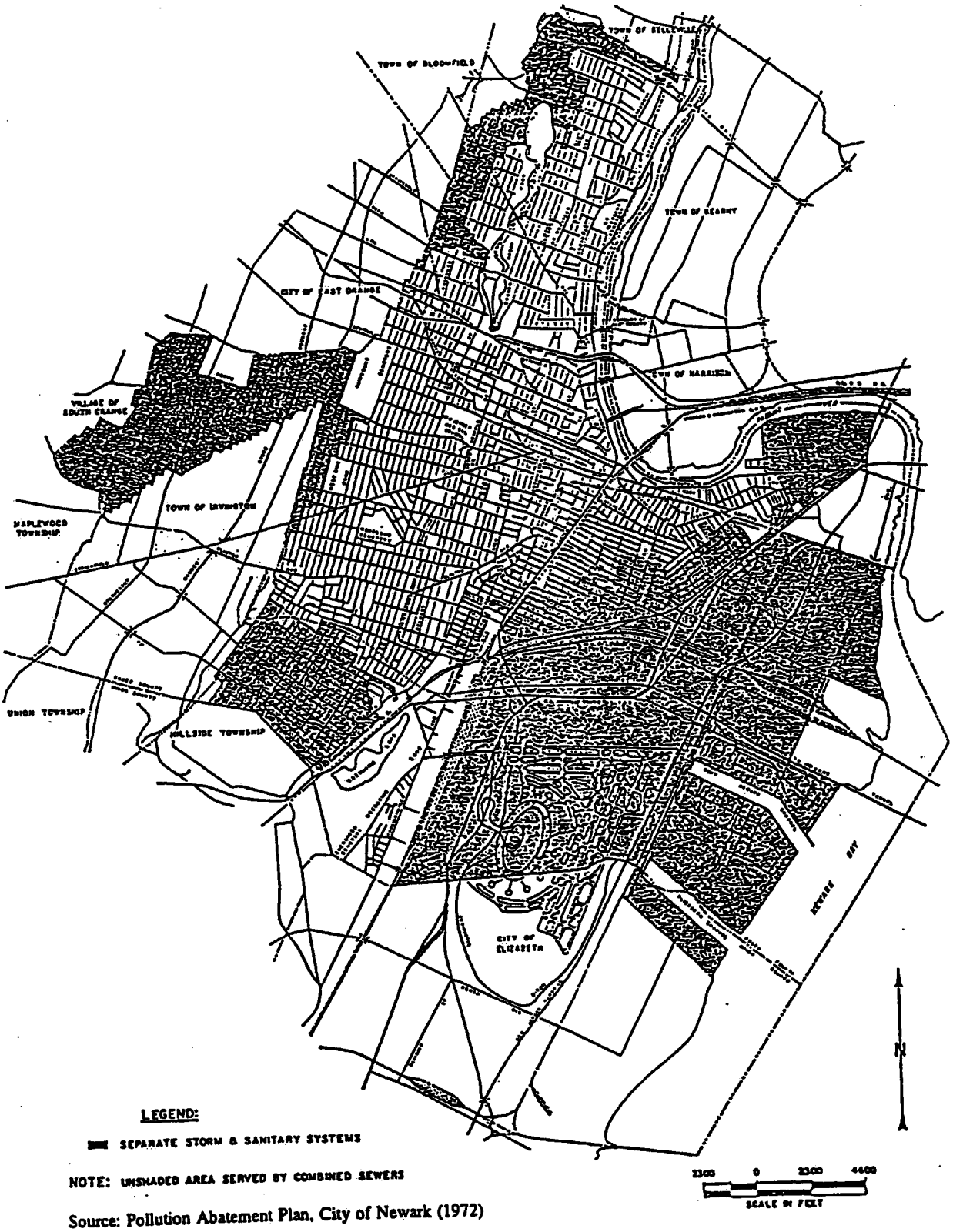

PVSC KNH INTERCEPTOR
PVSC MAIN INTERCEPTOR
SOUTH ST. INTERCEPTOR
SOUTH SIDE INTERCEPTOR
CROSS-BAY FORCE MAIN
PVSC TREATMENT PLANT
PASSAIC RIVER
HUDSON CO
ESSEX CO
INTERCHANGE 15
INTERCHANGE 15E
INTERCHANGE 14
NEWARK
Oak Island Junction
Port Newark
PORT NEWARK CHANNEL
NEWARK BAY
NEW JERSEY TURNPIKE
EXTENSION
4000FT
US GEOLOGICAL SURVEY
ELIZABETH, N.J. QUADRANGLE

**Figure 2**


CLINTON BOGERT ASSOCIATES




Source: Pollution Abatement Plan, City of Newark (1972)

**Figure 3. Area Distribution of the Newark Sewer System**

Receiving Waters

The City's CSOs discharge to (1) the tidal Passaic River, (2) the tidal Adams, Wheeler, Peddie, Queen and Waverly Ditches tributary to the Newark Airport Peripheral Ditch. The Meadowbrook relief outfall discharge to the freshwater Second River.

(1) Passaic River

The 75-mile Passaic River drains 935 square miles largely in New Jersey with a small portion in southern New York. Upstream reservoirs impound the water supply for Newark and much of northern New Jersey. It drops 33 feet at Beatties Dam, 63 feet at Great Falls in Paterson, and 17 feet over Dundee Dam in Garfield. The River is tidal for about 17 miles downstream of Dundee Dam. The semi-diurnal tide range at Newark is about 5.1 feet. The River has a long-term average flow of about 1,150 cfs at the USGS gaging station at Little Falls, which drains 762 square miles.

The downstream eight miles of the Passaic River form the City's eastern and northern boundary and its width varies from 350 to 700 feet. There are seven railway bridges, seven highway bridges and several overhead electric power cables which span the river within the City boundary. The NJDEP classifies the reaches of the Passaic River within the City boundary as SE-3. The water quality standards for SE-3 waters require that dissolved oxygen concentrations shall exceed 3.0 mg/l at all times and fecal coliform levels shall not exceed a geometric average of 1500/100ml.

(2) Peripheral Ditch

The Newark Airport Peripheral Ditch, constructed in 1965, is a relatively new, serpentine tidal waterway to drain about 10 square miles of southern Newark and northeastern Elizabeth. It replaced Bound Creek, Dead Creek, and the Peddie Canal that formerly provided drainage for the area. The four-mile Ditch varies in width between 100 and 200 feet and circles the southeastern, southern and western perimeter of the airport. The Ditch discharges into Elizabeth Channel in Newark Bay. The discharge is regulated by tide gates. The NJDEP classifies the Ditch as FW2-NT waters. The water quality standards require that dissolved oxygen concentrations shall exceed 4.0 mg/l at any timje and daily average not less than 5.0 mg/l. The fecal coliform levels shall not exceed a geometric average of 200/100ml.

(3) Second River

The seven-mile Second River drains about 15 square miles of central Essex County to the Passaic River at the Newark-Belleville boundary. From its tidal Passaic River outlet, the River rises to about 80 feet at Newark's Meadowbrook Park. Two miles west of Newark, in Bloomfield's Watsessing Park, the Second River divides. One branch extends northward to Montclair ant the other southwestward to West Orange. At one time, the West Orange treatment plant discharged to the Second River; however, West Orange flows are now treated at the Essex

Union Joint Meeting Plant in Elizabeth. A major tributary is Newark's relief sewer Outfall 001 that discharges into the River in Meadowbrook Park. The State classifies freshwater Second River along the City boundary as FW2-NT.

## B. Existing Monitoring Data and Their Evaluation

There are several past studies for the City and the region that include flow monitoring and sampling work in both dry and wet weather. These data are briefly reviewed as follows.

### Rainfall and Temperature Data

The National Weather Service's weather station at the Newark Airport has maintained long-term hourly records of precipitation and air temperature since 1948. Recently, a statistical analysis of these historical hourly rainfall data was performed for the Tri-City Sewerage Authority as a part of their CSO discharge permit requirement. The long-term average annual precipitation was 43.1 inches at Newark's gage . Assuming an inter-event interval of six hours, the average rainfall event depth and duration were 0.411 inches and 7.76 hours . The number of storm events averages 105 per year.

The analysis selected 1986 hourly data as the one that most closely matched the long-term total annual rainfall; the number of discrete storm events; and the average, standard deviation, and range of storm event volume, duration, average intensity and inter-event time. Hence, the 1986 precipitation data will be used to conduct continuous simulations of the Newark combined sewer system to determine its response to a typical sequence of storms.

### CSO Flow and Quality Data

#### B.1 The Pollution Abatement Plan for the City of Newark (1972)

Samples were taken at Peddie Street diversion chamber for the storms of 5/31/72, 6/16/72 and 6/22/72 mostly at intervals of no less than one hour and some at 2-4 hours. Samples were analyzed for conventional parameters. No flow data was obtained. Additional samples were obtained at a number of other CSO locations during dry weather and other storms. However, only grab samples were taken. Grab sample data is not useful for modeling purpose.

#### B.2 Overflow Analysis for PVSC (1976)

This study investigated 73 overflows (61 CSOs and 12 relief outfalls) within the jurisdiction of PVSC to determine their location, physical characteristics, and extent of service area. The investigation included a physical examination of each overflow chamber to verify dimension, elevations, pipe sizes, chamber condition, regulating devices, tide gates and outfall pipes. In the City of Newark area, 15 active overflows to the Passaic River and the Second River overflow were monitored and studied.

Overflow measurements were made at each active overflow to relate the overflow to rainfall where possible. Samples of overflows were taken to determine the quality of combined overflow. Measurements were conducted over a one year period (1973-1974) during which 70-80% of recorded rainfalls produced an overflow. For large overflows at Herbert Place, Fourth Street, Clay Street and Saybrook Place, rating curves relating overflow volume with loadings of TSS, COD and BOD were developed from data. Water quality data in dry and wet weather conditions showed a large variation among overflows. Since almost all regulators have since been modified and substantial land use changes have occurred, the water quality data and overflow rating curves established during the study can at best be used as reference only and are not useful for this modeling study.

### B.3 The PVSC Combined Sewer Overflow Facility Plan (1983)

This study was performed to determine the impact of the CSO discharge on the Passaic River and to evaluate abatement alternatives for each overflow. In addition to the development of a dynamic river model, a SWMM model was also developed within the lower Passaic River Drainage Basin, which includes the City of Newark, to provide a tool for estimating pollutional load associated with CSOs and stormwater discharge. The early version of SWMM-4 was used which includes the RUNOFF and TRANSPORT Blocks. Potential for in-pipe storage that may exist in large trunk sewers was evaluated with the HEC-2 model.

In Newark, wet weather flow metering and sampling were performed at nine CSO systems for a total of 23 stations with the following distribution: City Dock (3), Clay Street (10), Freeman Street (1), Herbert Place (2), Jackson Street (1), Polk Street (1), Rector Street (1), Saybrook Place (2), and Verona Avenue (2). The number of storms monitored varied from 2 to 4. Samples were taken at 15-minute intervals throughout actual overflow events. Water quality parameters analyzed included BOD, TSS, NO2-N, NO3-N, and NH3-N. None of the samples was analyzed for fecal coliform and heavy metals. The rainfall data at Newark Airport was supplemented by a temporary tipping bucket raingage installed at the fire station on Summer Street for surface runoff analysis in the City drainage boundary.

For the SWMM model, subcatchments were delineated and land use information was developed for each subcatchment. Sewer system data were derived from existing sewer maps and augmemted by a system survey which included the locations of drainage inlets; combined, storm and sanitary sewers; manhole diversion chambers; internal overflows; outlet facilities ; known bypasses; and PVSC interceptor and regulator systems.

The CSO flow and water quality data were obtained in 1981-1982. Since then, substantial demographic changes have occurred in the City and PVSC has improved diversion system regulators and modified their operation. Hence, the data collected then would not reflect the conditions that exist today. In addition, water quality data were not collected and analyzed according to the presently approved QA/QC procedures and flow metering devices reflect the technology available in early 1980's. Hence, it would be necessary to obtain an independent set of flow and water quality data that meet the needs of the sewer system model selected for

the study and satisfy the City's desire to confirm PVSC billing to the City and sewage flows from East Orange and Belleville. The existing time synchronized rainfall/flow/water quality data can be used as reference or supplement the new data as appropriate.

The sewer system information obtained for the development for the SWMM model will be utilized for the construction of a new SWMM EXTRAN model or other model selected for this study.

River Water Quality and Tide Data

Extensive river water quality and tide data were collected in the Passaic River during the study completed in 1983. Two nearest sampling and tide gage stations to the City were at Central Railroad Bridge, Jackson Street Bridge and Rutger Street Bridge in Belleville.

Extensive water quality samples were taken at three-hour intervals for the following periods in 1981: March 10-20, April 14-17, July 14-24 and September 15-18, and December 11-20. Samples were taken both during dry and wet weather periods. The data collection was designed for the calibration and verification of the Passaic River water quality model. Water quality parameter of interest was the dissolved oxygen. Fecal coliform data were not obtained.

## IV. Proposed Monitoring Program

### A. Flow Monitoring

Based on the needs of sewer system hydraulic model calibration and verification and City's desire to (1) alleviate street flooding problems and (2) confirm PVSC billing to Newark and out-of-town users of the Newark system, it is proposed to set up the following continuously flow monitoring stations:

(a) Immediately upstream and downstream of regulators of all 24 CSOs and level sensors at the nearby PVSC interceptor sewer;
(b) At four internal sewer locations in areas tributary to Clay Street and Peddie Street CSOs;
(c) Eight influent sewers from East Orange to the City;
(d) Influent sewers from Belleville, the locations of which are to be determined;
(e) At outgoing sewers from the Vailsburg District and the southwestern section bordering Hillside to the Joint Meeting trunk sewer;
(f) At about ten City sewers which connect directly to the PVSC interceptor sewer without a diversion chamber.

The total number of metering stations would be about 70. The metering sewers will have sizes ranging from 8" to 144". An investigation therefore should be performed to determine the most suitable metering device for each station. It is likely that several meter types and brands will be used in this study.

Actual metering sites will be determined with the use of existing sewer information and a field reconnaissance to gather site information of metering manholes. These sites are to be chosen under the general criteria that they would yield useful flow data for model calibration and site conditions that are conducive to obtaining accurate flow measurements. In field reconnaissance, manholes are opened to observe the flow pattern, velocity, flow depth, amount of sediment, accessibility, history of surcharge and backwater conditions, and possible danger from harmful gases or chemicals, etc. In addition, heavy traffic sites should be avoided to assure the safety of field personnel.

Continuous flow metering will continue for a 12-month period at those stations that measure the Newark flows to the PVSC and Joint Meeting STPs and out-of-town flows to the Newark system. This applies to a majority of the proposed metering stations. For the remaining few stations that are installed mainly for gathering wet weather data, monitoring period will be shorter, to be about three months. This duration is figured to be long enough for collecting adequate wet weather flow samples for model calibration.

## B. Rainfall Monitoring

Rainfalls can vary significantly in a short distance particularly that are associated with thunderstorms in summer time. To obtain rainfall data that are representative of the precipitation in various parts of the City, five new rain gages will be installed in addition to the existing long-term gage at the Newark Airport. These gages will be installed on top of public buildings, preferrably fire houses and DPW buildings, where they are accessible for maintenance and are secured from vandal. Raingage data may be recorded in a on-site data logger or is transmitted to a centralized station for processing. There are several commercially available rain gages and one type will be selected for the City.

## C. CSO Quality Monitoring

The proposed CSO water quality monitoring program is to obtain pollution concentration data, time synchronized with flow data, for calibration and verification of sewer system water quality model and for determining pollutant load delivered from the City to the PVSC Plant.

It is proposed that at least ten water quality sampling sites will be selected for collection of wet weather samples. These sites should coincide with the flow metering stations described above, therefore the flow metering and sampling sites are to be selected together. The primary factors for selecting sampling sites include (1) drainage area that determines CSO volume; and (2) predominant land use (residential, commercial, and industrial) that will facilitate the development of pollutant loading for application to the rest of City with similar land use. Without the benefit of information in the land use report that is being developed for the City, CSOs with large tributary area would be a good candidate for sampling. These CSOs include Verona Avenue, Herbert Place, Clay Street, Saybrook Place, City Dock, amd Peddie CSO. It is anticipated that additional sampling locations are in collection sewer in large drainage districts such as Peddie and Clay Street systems and in industrial areas. The final determination shall be

made after a carefull analysis of the land use data.

Since the State has waived the requirement in the City's permit to collect and analyze heavy metals, CSO quality parameters analyzed will be limited to the conventional pollutant parameters listed in the General Permit. The QA/QC plan for field data collection and laboratory analysis will be developed for collecting the conventional pollutant only.

Wet weather samples will be collected for a minimum of four moderate to heavy storms. Sampling intervals will be 15 minutes or less during the first hour of runoff and may increase as the storm progresses. Experience indicates that field attempt to collect data for about six storm events would be required to obtain useful data from four storm events. Under the normal weather conditions for the region, water quality data collection would take about three months.

In additon to wet weather sampling, dry weather hourly samples would also be taken at wet weather sampling stations for at least two days for establishing the baseflow conditions. At out-of-town sewage discharge points to the Newark system, 2-hourly water quality samples will be taken for analysis for a minimum of five days. The data will be used with the flow data to estimate the pollutant loads that either entering or leaving the City sewer system.

All field data collection and laboratory analysis will follow the procedures described in the Quality Assurance Project Plan to be prepared.